

It is also acceptable to perform the process of aligning in position the IC chip 1 on the electrodes 2 of which the bumps 3 have been formed through the aforementioned preceding process by the bonding tool 8 heated by a built-in heater 8a such as a ceramic heater or a pulse heater with the electrodes 5 of the board 4 prepared through the aforementioned preceding process so that the electrodes 5 of the board 4 correspond to the electrodes 2 of the IC chip 1 as shown in Fig. 38E and the process of performing pressure bonding as shown in Fig. 38F after the positional alignment, by means of one positional alignment and pressure bonding apparatus of, for example, the position aligning and pressure bonding apparatus of Fig. 38E. However, it is also acceptable to perform the positional alignment process and the pressure bonding process by separate units of, for example, the positional alignment device of Fig. 42B and the bonding device of Fig. 42C, respectively, in order to improve the productivity by concurrently performing the positional alignment work and the pressure bonding work when continuously manufacturing, for example, a lot of boards. Fig. 42C shows two bonding devices 8 provided for the purpose of improving the productivity, by which two portions of one circuit board 4 can be concurrently subjected to pressure bonding.

The circuit board 4 is provided by a multilayer

ceramic board, FPC, a glass fabric laminate epoxy board (glass epoxy board), a glass fabric laminate polyimide resin board, an aramid unwoven fabric epoxy board (for example, a resin multilayer board sold with a registered trademark of "ALIVH" produced by Matsushita Electric Industrial Co., Ltd.), or the like. These boards 4 do not always have a complete plane since warps and undulations are generated due to thermal history, cutting and processing. Accordingly, as shown in Fig. 42A and Fig. 42B, by locally applying heat and load to the circuit board 4 via the IC chip 1 from the bonding tool 8 side toward the stage 9 side by means of the bonding tool 8 and the stage 9 each of which the parallelism is controlled so that the parallelism is adjusted to, for example, about 10  $\mu\text{m}$  or less, the warp of the circuit board 4 in the applied portion is corrected. The IC chip 1 is warped concave about the center of the active surface. By pressurizing the IC chip with a heavy load of not smaller than 20 gf per bump at the time of bonding, the warps and undulations of both the board 4 and the IC chip 1 can be corrected. The warp of the IC chip 1 is generated by an internal stress caused when a thin film is formed on Si in forming the IC chip 1. The quantity of deformation of the bump is about 10 to 25  $\mu\text{m}$ , which becomes tolerated by each bump 3, which adapts itself with the deformation of the bump 3 to the

influence of the undulation that appears on the surface from the inner layer copper foil originally owned by the board of this grade.

Thus, a heat of, for example, 140 to 230°C is applied to the thermosetting resin sheet 6 located between the IC chip 1 and the circuit board 4 for, for example, about several seconds to 20 seconds in a state in which the warp of the circuit board 4 is corrected, and this thermosetting resin sheet 6 is hardened. At this time, the thermosetting resin 306m, which constitutes the thermosetting resin sheet 6, flows first and encapsulates the IC chip 1 up to the edge of IC chip. Moreover, the resin, which is naturally softened at the beginning when heated, generates a fluidity of a flow to the edge as described above. By making the volume of the thermosetting resin 306m greater than the volume of the space between the IC chip 1 and the circuit board 4, the resin flows and leaks out of this space, allowing the encapsulation effect to be produced. Subsequently, the heated bonding tool 8 is moved up, by which the heating source disappears to rapidly reduce the temperature of the IC chip 1 and the thermosetting resin sheet 6. The thermosetting resin sheet 6 loses its fluidity, and as shown in Fig. 38F and Fig. 41C, the IC chip 1 is fixed onto the circuit board 4 with the hardened thermosetting resin 6s. Moreover, if the